

4.3.1.2.3 Aquatic biological monitoring

4.3.1.2.3.1 Watershed biological monitoring

Aquatic biological monitoring of stream sites in BCV watershed (Figure 4.4) is used to evaluate stream ecological conditions over time, providing an important measure of the effectiveness of both past and potential future remedial and abatement actions in the watershed. Biological monitoring data for streams in BCV include results on (1) contaminant accumulation in fish, (2) fish community surveys, and (3) benthic macroinvertebrate community surveys.

To evaluate instream contaminant conditions and potential human and ecological risks in the BCV watershed, fish are collected twice a year and analyzed for a suite of metals and PCBs at sampling locations BCK 3.3, BCK 9.9, and BCK 12.4 (Figure 4.4). Also, an evaluation of overall ecological health of the streams is conducted by monitoring fish and benthic macroinvertebrate communities at BCK 3.3, BCK 9.9, BCK 12.4, and NT-3 (a tributary to Bear Creek). Mean mercury concentrations in rock bass from lower Bear Creek (BCK 3.3) averaged 0.59 µg/g in fall 2018 and 0.57 µg/g in spring 2019 (Figure 4.17). These concentrations are similar to concentrations seen in FY 2018 and remain above the EPA-recommended fish-based AWQC of 0.3 µg/g, and are elevated with respect to concentrations in fish collected from the reference site (HCK 20.6; Figure 4.4). The EPA-recommended fish-based AWQC of 0.3 µg/g is not a ROD-specified goal and is used for comparison purposes only. The overall temporal pattern of mercury concentrations in BCK 3.3 fish suggests seasonally variable levels in the general range of approximately 0.5 – 0.8 ppm, with a temporary increase in fish mercury concentrations over the 2011 – 2013 time period (during which time fish concentrations ranged from approximately 0.8 – 1 ppm on multiple occasions).

Over recent decades beavers have expanded their range in the Oak Ridge area and as a result lower Bear Creek has had multiple large beaver dams that have extensively flooded riparian zones. The dams have created deeper stream pools suitable for rock bass, which has expanded its range in the last few years to the middle sections of Bear Creek nearer BCK 9.9. In FY 2019, a full collection of six rock bass were collected from BCK 9.9 in both the spring and fall. Their average mercury concentrations are slightly higher than recent concentrations in lower Bear Creek (0.90 µg/g in fall 2018 and 0.64 µg/g in spring 2019; Figure 4.17).

As seen at many other monitoring sites, mean PCB concentrations in sunfish collected from Bear Creek have fluctuated significantly over time, presumably due to annual differences in the type of prey and their relative PCB concentrations. In 2019, the mean PCB concentrations in rock bass fillet at the lowermost site (BCK 3.3) was 0.20 – 0.53 µg/g, while PCB levels in redbreast and rock bass at the site further upstream (BCK 9.9) were significantly higher (approximately 1.04 – 1.07 µg/g; Figure 4.18). While regulatory guidance and human health risk levels have varied widely for PCBs over the years, recently in the state of Tennessee, the water quality criterion (0.00064 µg/L for total PCBs; TDEC 2019) under the recreation designated use classification has been used by TDEC to calculate the fish tissue concentration triggering impairment and a TMDL, which is 0.02 µg/g in fish fillet (TDEC 2010a,b,c). TMDLs are used to develop controls for reducing pollution from both point and non-point sources in order to restore or maintain the quality of a water body and ensure it meets the applicable water quality standards. The fish PCB concentrations in Bear Creek are still well above the calculated TMDL concentration, which is not a ROD-specified goal and is used for comparison purposes only.